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(58) Field of search
B1D
B2P
Selected US specifications from IPC sub-classes B01D B04C

(54) Interceptor units

(57) An interceptor unit for receiving mixtures of petrol, oil and water and for discharging relatively clean water comprises a vessel (2) divided into an inlet chamber (4), an interceptor (6) and an outlet chamber (8). An inlet (12) enters the inlet chamber (4), and an outlet (36) discharges from the outlet chamber (8). Flow entering the inlet chamber (4) is transferred to the interceptor (6) through a conduit (18), where separation of the petrol and oil on the one hand and the water on the other hand takes place. From the lower region of the interceptor (6), relatively clean water is transferred to the outlet chamber (8) through an upwardly extending transfer passage (28), to be discharged through the outlet (36). Under conditions of heavy flow, the conduit (18) is unable to accept all of the mixture entering through the inlet (12), and some flow takes place from the lower region of the inlet chamber (4) to the outlet chamber (8) through an overflow arrangement (38).

FIG.1.

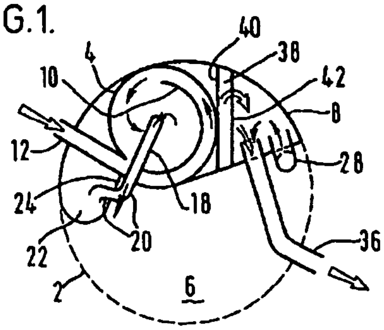
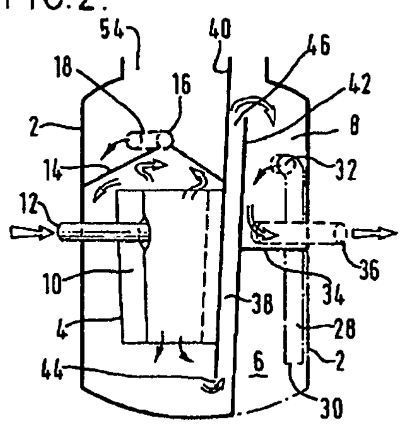


FIG.2.



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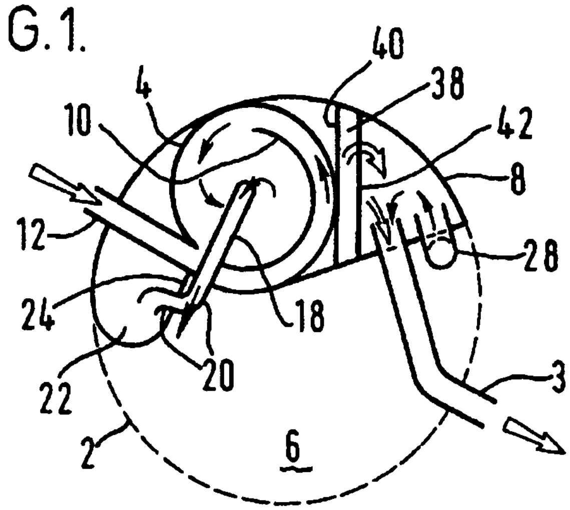
The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

FIG.1.


40
38
4
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42
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18
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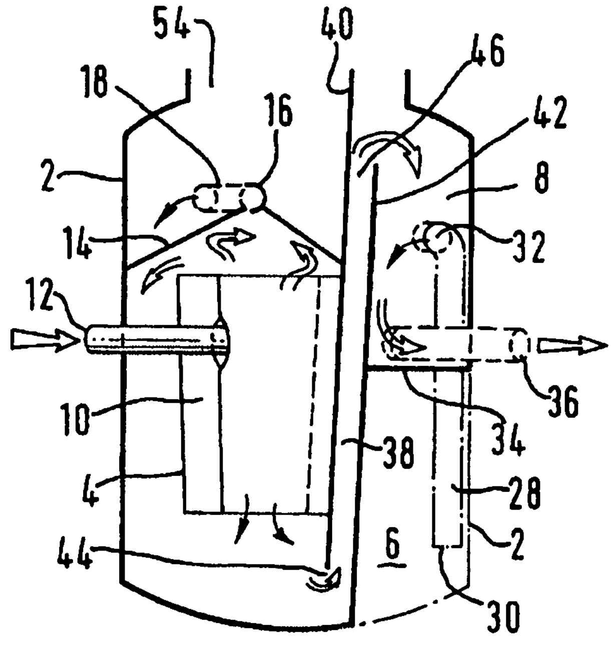
2
6

FIG.2.


54
40
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32
12
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34
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4
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44
6
2
30

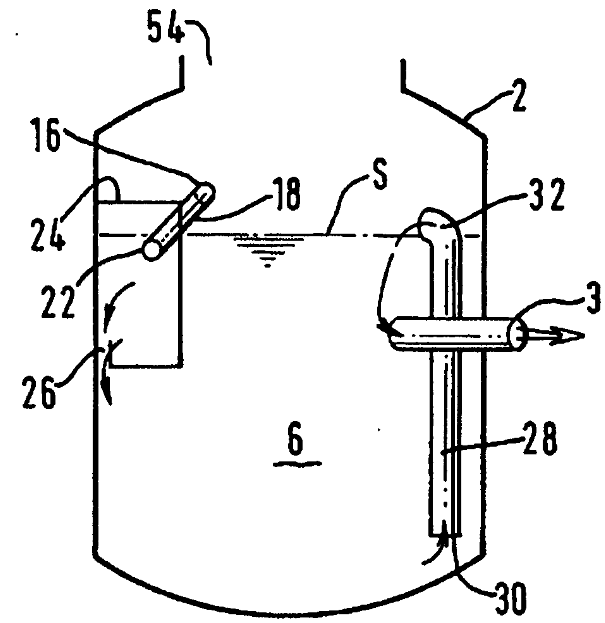

FIG. 3.

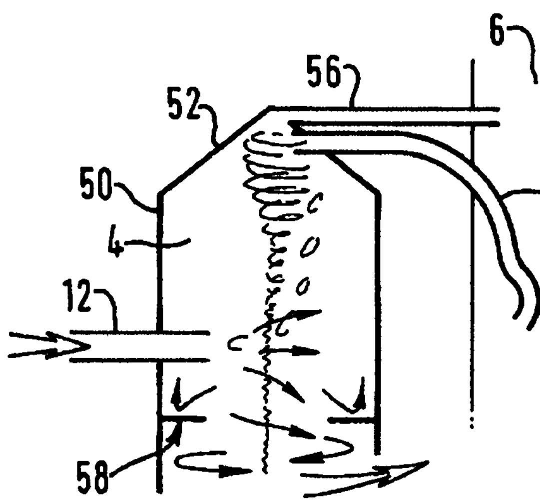

FIG. 6.

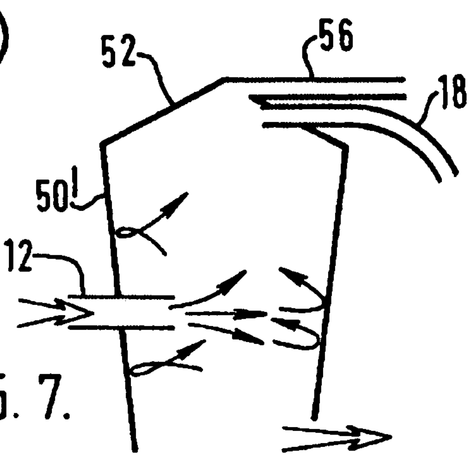

FIG. 7.

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FIG.4.

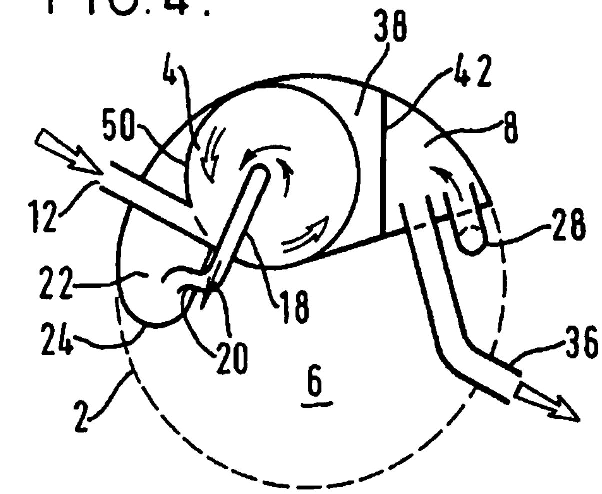
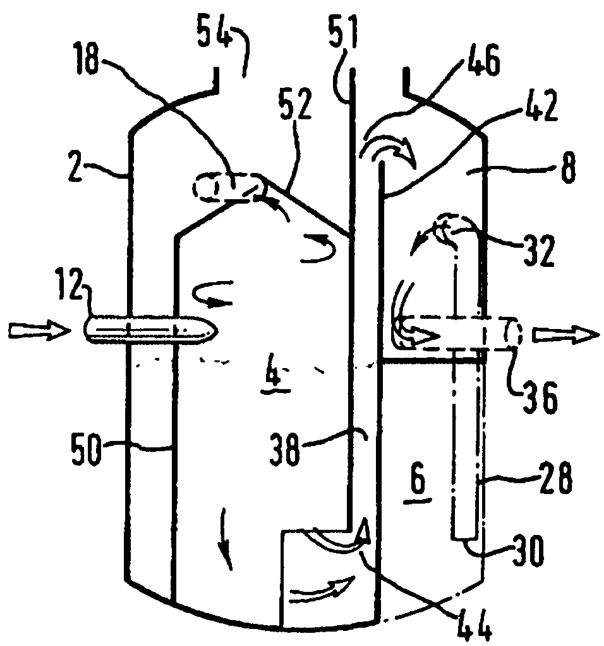
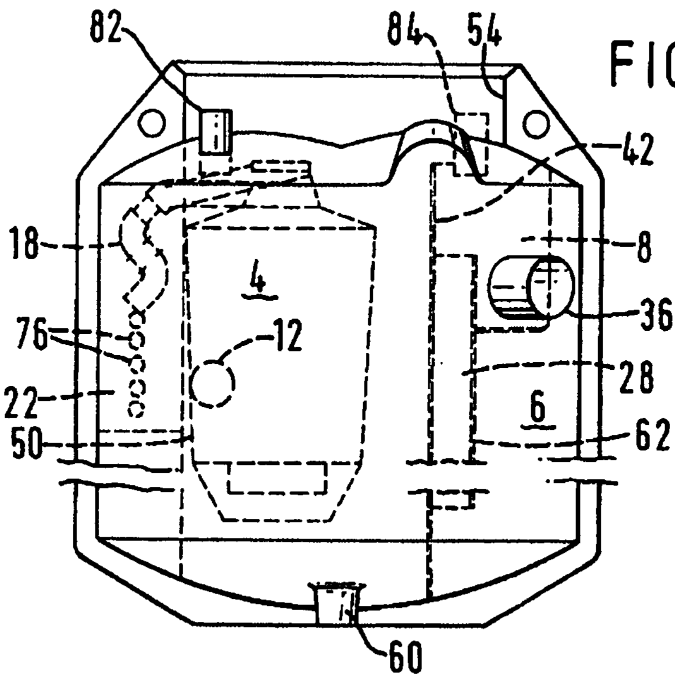


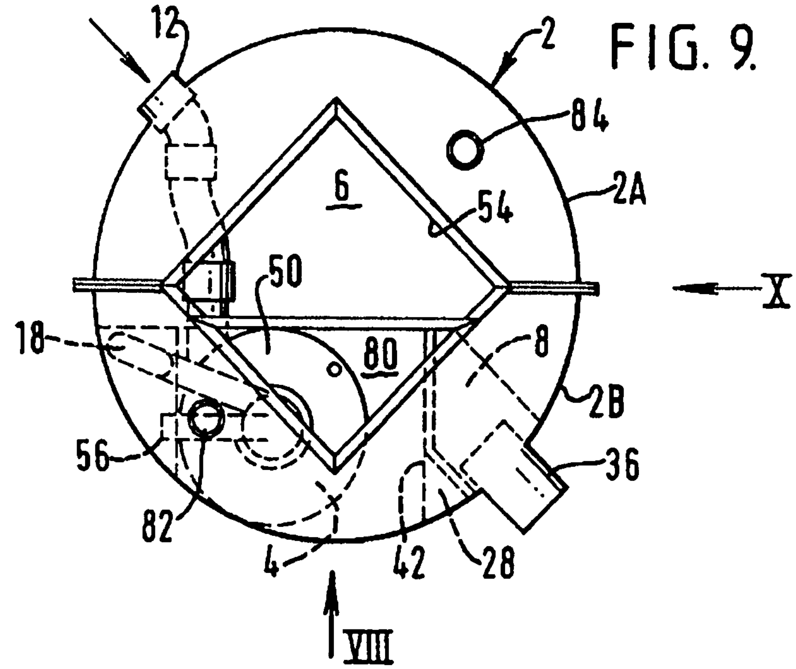
FIG.5.





82
84
54
42
18
8
4
36
76
12
28
22
6
50
62
60

FIG. 8.



12
2
84
6
2A
54
50
X
18
80
8
2B
56
36
82
4
42
28
VIII

FIG. 9.

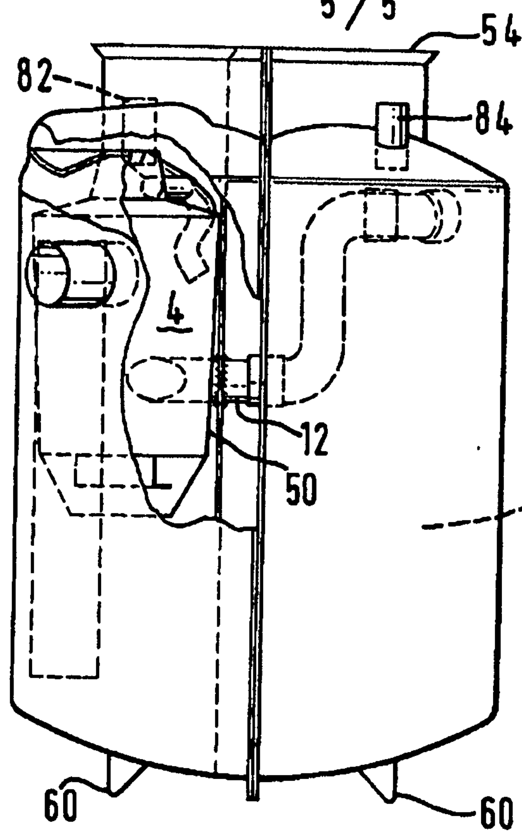
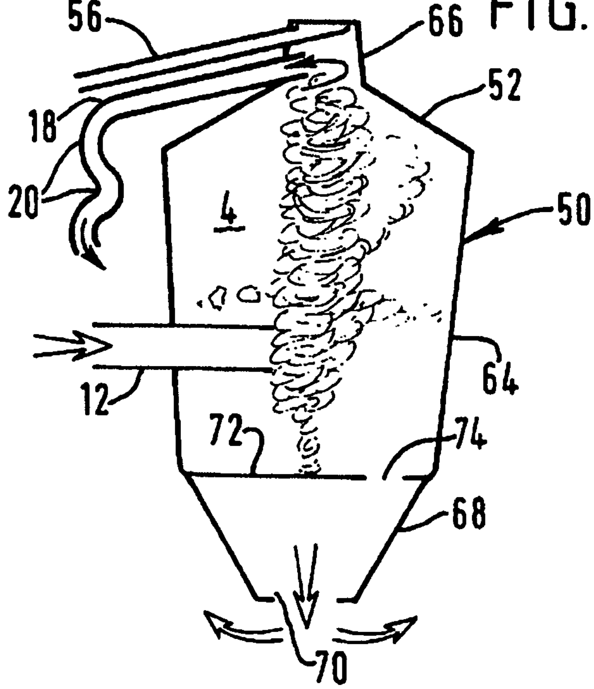


FIG. 10.

FIG. 11.



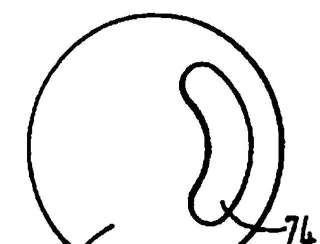


FIG. 12.

SPECIFICATION

Interceptor Units

This invention relates to interceptors, and particularly, although not exclusively, to interceptors for separating petrol or oil from water before the water is discharged into a sewer or water course.

A petrol and oil interceptor, in general terms, comprises a chamber in which the incoming flow (a mixture of petrol, oil and water) is allowed to settle so that the petrol and oil separates from the water and floats to the top. The water from the lower part of the chamber is allowed to flow to a sewer or drain. At intervals, the accumulated petrol and oil, together with any solid waste, is removed from the interceptor. Such interceptors operate satisfactorily at low to moderate flow rates, but at high flow rates, for example during heavy rainfall, the energy of the incoming flow can stir up the contents of the interceptor so that the accumulated petrol and oil may be flushed out of the interceptor to the sewer or drain.

To overcome this problem, by-pass units are known which direct some of the incoming flow, at heavy flow rates, to the sewer or drain without passing through the interceptor.

According to the present invention there is provided a by-pass unit for an interceptor, comprising an inlet chamber having an inlet and an outlet, the outlet being situated at or near the top of the inlet chamber for conveying liquid from the by-pass unit to an interceptor, the inlet chamber communicating at its lower region with an overflow arrangement which discharges at a level at or above that of the outlet of the inlet chamber, whereby, at relatively low flows through the inlet, the entire flow passes to the interceptor through the outlet, whereas, at higher flows, some of the flow passes through the overflow arrangement to by-pass the interceptor.

In an embodiment in accordance with the present invention, means is provided for causing flow entering the inlet chamber to undergo a swirling motion, at least at moderate flow rates. This causes some preliminary separation of the components of the incoming flow. For example, the inlet may be directed tangentially into the inlet chamber, or the inlet chamber may be provided with an internal helical baffle or scroll for promoting the swirl. The inlet chamber is preferably circular when viewed in horizontal cross-section. The inlet chamber may be tapered, for example from top to bottom. The inlet chamber may be provided at the top with a roof which slopes upwardly from the sides, the outlet being provided at or near the uppermost portion of the roof.

The outlet may communicate with the interceptor through a conduit which provides a tortuous path for liquid passing through the conduit so as to restrict the flow which the conduit can accept. The conduit may open into a settling compartment in the interceptor, in order to minimise disturbance of liquid in the interceptor by incoming liquid.

The overflow arrangement may discharge into an outlet chamber which also receives outlet flow from the interceptor. An outlet, for example extending from a lower region of the outlet chamber, enables the outlet chamber to discharge to a sewer or drain. The interceptor may communicate with the outlet chamber through a transfer passage which may comprise a pipe extending from the lower region of the interceptor to the outlet chamber. The overflow arrangement may comprise a passage defined partially by a partition disposed between the inlet chamber and the outlet chamber, this partition providing a weir for liquid flowing into the outlet chamber.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a diagrammatic sectioned plan view of an interceptor unit;

Figure 2 is a diagrammatic sectioned side view of the interceptor unit of Figure 1 with some parts omitted;

Figure 3 is a diagrammatic sectioned side view corresponding to Figure 2 but with other parts omitted;

Figures 4 and *5* correspond to Figures 1 and 2 but show an alternative embodiment;

Figures 6 and *7* show two alternative constructions for part of the interceptor units of Figures 1 to 5;

Figure 8 is a side view of a further embodiment of an interceptor unit, taken in the direction of the arrow VIII in Figure 9;

Figure 9 is a plan view of the interceptor unit of Figure 8;

Figure 10 is a view taken in the direction of the arrow X in Figure 9;

Figure 11 is a side view of a part of the interceptor unit of Figures 8 to 10; and

Figure 12 shows a component of the part shown in Figure 11.

The interceptor unit of Figures 1 to 3 comprises a vessel 2 which is divided by internal partitions into an inlet chamber 4, an interceptor 6 and an outlet chamber 8. The inlet chamber 4 contains a helical flow-directing member 10 into which extends a tangential inlet 12. The inlet chamber 4 has a roof 14 which slopes upwardly from the sides of the inlet chamber 4 in a conical manner, although alternatively it could be domed. At its uppermost point, the inlet chamber 4 has an outlet defined by an aperture 16 which opens into a conduit 18. In the illustrated embodiment, the conduit 18 has bends 20 laid horizontally and progressing downwards, these bends providing a tortuous path for liquid flowing through it. However, these bends may be replaced by other flow directing means for creating the tortuous path. For example, the conduit 18 may be replaced by vanes forming the outer wall of each bend. Under conditions of high flow, the mixture will flow from vane to vane, losing momentum, while slow flows will fall directly into the interceptor 6. The conduit 18 opens into a settling compartment 22 defined by a baffle 24. The settling compartment 22 is open to the interceptor 6 through a gap 26.

The interceptor 6 communicates with the outlet chamber 8 through a transfer passage provided by an upright pipe 28. The inlet 30 of the pipe 28 is in the lower region of the interceptor 6, while the outlet 32 is situated in the outlet chamber 8 below the level of the aperture 16. The outlet chamber is in the upper region of the vessel 2, and is separated from the underlying part of the vessel 2 by a floor 34. An outlet 36 extends from the outlet chamber 8 at a position just above the floor 34.

The inlet chamber 4 communicates with the outlet chamber 8 through an overflow passage 38. The inlet chamber 4 and the overflow passage 38 constitute a by-pass unit for by-passing the interceptor 6, as will be described later. The overflow passage 38 is defined between two partitions 40 and 42, of which the partition 40 extends downwardly from the top of the vessel 2 and terminates short of the bottom of the vessel to leave an opening 44 for the overflow passage 38. The partition 42 extends from the bottom of the vessel 2 and terminates at a level above the level of the aperture 16 to provide an outlet opening 46 for the overflow passage 38. The top edge of the partition 42 provides a weir for liquid flowing through the overflow passage 38.

In operation of the interceptor unit at low to moderate inlet flow rates, a mixture of oil, petrol and water, for example from a petrol filling station forecourt, enters the vessel 2 through the inlet 12. The mixture flows into the inlet chamber 4 and, provided the flow rate is sufficient, performs a swirling motion under the influence of the member 10. This swirling motion causes the lighter components of the mixture, i.e. the oil and petrol, to migrate towards the centre of the flow so that particles of oil and petrol will coalesce and, because of their lower density, rise towards the roof 14. This upward movement is assisted by a degree of uplift which arises as a result of the downwardly tapered form of the inlet chamber 4. Water, the heavier component of the mixture, together with any solids which are denser than water, will tend to remain on the outside of the flow in the inlet chamber 4, and to migrate downwardly towards the bottom of the inlet chamber 4, as also will heavy solid impurities, which will collect at the bottom of the inlet chamber 4. As a result, the liquid reaching the top of the inlet chamber 4 will normally comprise oil and petrol with a small proportion of water while that falling to the bottom will comprise water with a small proportion of oil and petrol. From the top of the inlet chamber 4, the mixture will pass through the aperture 16 and the conduit 18 to the settling compartment 22. During passage through the conduit 18, the mixture will be braked by the bends 20 and further decelerated as it diffuses on entering the settling compartment 22. Consequently, the mixture will flow relatively gently through the gap 26 into the main body of the interceptor 6, which has the function of a flotation chamber in which the mixture is substantially quiescent, allowing efficient separation of the mixture into a layer of oil and petrol on the surface of a body of substantially clean water. As shown in Figure 3, the surface S of the liquid in the interceptor 6 will initially be at the level of the transfer passage outlet 32. However, this level S will rise as the quantity of oil and petrol in the interceptor 6 increases as a result of the lower density of the petrol and oil balancing the column of water in the transfer passage 28. As flow enters the interceptor 6, clean water from the lower part of the interceptor 6 will enter the transfer passage 28 through the inlet 30 and be discharged into the outlet chamber 8 through the outlet 32. From the outlet chamber 8, the clean water will pass to, for example, a sewer through the outlet 36.

It will be appreciated that the size of the conduit 18, as well as the bends 20, will restrict the rate of flow through the conduit 18. The purpose of this is to avoid overloading the interceptor by admitting liquid to it at a rate which will stir up the contents of the interceptor 6 and prevent efficient separation from occurring. Under storm conditions, rain water mixed with oil and petrol may enter through the inlet 12 at a rate faster than that which can be accepted by the conduit 18. Should this happen, the back pressure in the inlet chamber 4 will cause the level of the mixture in the overflow passage 38 to rise above its normal level, which is the level of the aperture 16, until it overflows into the outlet chamber 8 through the opening 46 and over the top edge of the partition. It will be appreciated that the mixture flowing through the overflow passage 38 will be the less contaminated mixture, and may well be substantially clean water, passing through the inlet 44 at the bottom of the inlet inlet chamber 4. Consequently, although the overflowing mixture will not have undergone any separation by settling in the interceptor 6, it will be substantially cleaner than the mixture entering through the inlet 12 because it will have been subjected to a strong vortex action in the inlet chamber 4. The result is that, even under storm conditions, the flow reaching the outlet 36 contains little, or no, petrol or oil.

The embodiment shown in Figures 4 and 5 is similar in many respects to that of Figures 1 to 3, and similar components are designated by the same reference numbers.

However, instead of the member 10 of Figures 1 to 3 which creates a helical flow within the inlet chamber 4, the inlet chamber 4 is defined by a cylindrical member 50 having a conical roof 52. The conduit 18 communicates, as in Figures 1 and 3, with the uppermost part of the roof 52 through an aperture 16. The lower end of the member 50 is open. Instead of the partition 40 of the embodiment of Figures 1 and 3, the overflow passage 38 is defined between the passage 42 and part of the cylindrical side wall of the member 50, this part having an upwardly extending projection 51 terminating above the highest liquid level in the vessel 2. Operation of the interceptor unit shown in Figures 4 and 5 is largely the same as that of Figures 1 to 3, the tangential orientation of the inlet 12 causing the inlet flow to swirl within the member 50, again causing the oil and petrol components of the mixture to migrate to the centre of the swirl and upwardly towards the aperture 16, while the

water remains on the outer part of the swirl and migrates downwardly. As before, under normal flow conditions, mixture from the top of the inlet chamber 4 flows to the outlet chamber 8 via the intermediate chamber 6, while under storm conditions the mixture from the lower part of the inlet chamber 4 can flow directly to the outlet chamber 8 via the overflow passage 38.

As will be apprecaited from Figures 1 and 4, the inlet chamber 4 and the outlet chamber 8 occupy only a small part of the total volume of the vessel 2. In particularly, they are situated wholly on one side of a diameter of the vessel 2, within a sector having an angle of approximately 135° or less. Consequently, a large part of the volume of the vessel 2 is available as the interceptor 6

In both embodiments, the vessel 2 is provided at its upper end with an access hatch 54 which would normally be closed by a cover. The hatch 54 provides access to the vessel 2 for removing accumulated petrol and oil from the separated mixture in the interceptor 6, and for removing any settled solid material from the bottom of the inlet chamber 4. The cover would seal against the partition 40 (Figure 2) or the projection 51 (Figure 5) to prevent flow from the by-pass unit, comprising the inlet chamber 4 and the passage 38, from entering the intereceptor 6.

Also, although not shown in Figures 1 to 5, the inlet chamber 4 and the interceptor 6 would be vented by means of vents positioned above the maximum liquid level, to enable fumes to escape from the vessel to the surroundings.

The conduit 18 may also be vented to the surroundings, but a preferred arrangement is shown in Figure 6. In Figure 6, the conduit 18 is shown as communicating with the inlet chamber 4 at a position slightly below the top of the member 50. A vent pipe 56 is provided at the very top of the member 50, and provides communication between the inlet chamber 4 and the interceptor 6. The vent pipe 56 slopes slightly downwardly away from its connection to the member 50 so that any liquid entering it can flow into the interceptor 6. In operation froth formed at the top of the inlet chamber 4, as a result of entrained air entering through the inlet 12 is coughed through the vent pipe 56 into the interceptor, while oil and petrol, with substantially no air, can flow through the conduit 18.

Figure 6 shows a further optional feature, in the form of an apertured disc 58 disposed within the inlet chamber 4 below the inlet 12. This disc 58 creates a recycling effect on the newly entering downwards flow at the outside of the inlet chamber 4, and increases the upthrust on the oil and petrol at the top of the chamber 7.

Figure 7 shows a further alternative, somewhat similar to that of Figure 6, in which the side wall of the member 50 is tapered from top to bottom. This produces an effect similar to that of the disc 58 in Figure 6.

Figures 8 to 11 show a preferred, practical embodiment of an interceptor unit in accordance with the present invention. Parts which correspond to those shown in previous drawings are indicated by the same reference numbers. The general arrangement and operation of the interceptor unit shown in Figures 8 to 12 are similar to those of the units previously described, and the following description is consequently confined to those features which are different.

It will be seen from Figures 8 to 10 that the vessel 2 is formed in two halves 2A and 2B which are bolted together at mating flanges. The halves 2A and 2B define the hatch 54, which is square as seen in plan. Feet 60 are provided to make the unit stable during installation.

The transfer passage 28 is bounded by the partition 42, the wall of the vessel 2 and a partition 62. The top edge of the partition 62 constitutes a weir for water flowing into the outlet chamber 10 from the interceptor 6.

The inlet chamber 4 is defined by a member 50 which corresponds to the cylindrical member 50 of Figures 4 and 5 is situated in a space 80 within the vessel 2. The space 80 outside the inlet chamber 50 corresponds to the overflow passage 38 of Figures 1 to 5. The member 50 is circular in cross-section and its main wall tapers downwardly. The roof 52 slopes upwardly from the wall 64 to a cap 66 from which the conduit 18 and the vent pipe 56 project. At its lower end, the main wall 64 terminates at a conical outlet portion 68 having a central outlet opening 70.

A partition 72 is provided at the lower end of the main wall 64. The partition 72 has an aperture 74, which is situated away from the axis of the member 50, providing communication between the two sides of the partition 72.

The settling compartment 22, into which the conduit 18 discharges, has holes 76 and a lower opening through which the flow entering the compartment 22 can pass to the interceptor 6. Vents 82 and 84 are provided for venting, respectively, the space 80 and the interceptor 6.

In operation under storm conditions, a vortex is formed in the member 50, the central part of which is largely oil and petrol. This oil and petrol is prevented from passing into the conical portion 68 by the partition 72. Substantially clean water can, however, pass through the aperture 74 and the outlet aperture 70 to pass directly to the outlet chamber 10 over the weir at the top edge of the partition 42 (see Figure 8). The conical portion 68 provides additional upthrust to the mixture in the member 50 to direct incoming mixture upwardly. Instead of providing the central outlet opening 70, one or more side openings may be provided in the wall of the conical portion 68.

In use, the vessel would be installed, suitably shielded, below the ground surface in a suitable excavation.

It will be appreciated that the embodiments discussed above are shown only diagrammatically in the drawings, and that the various components of the interceptor units described can be constructed in many different ways. It is envisaged that the main body of the vessel 2 and the partitions within it will be constructed from plastics material, such as glass reinforced plastics. Furthermore, although

the transfer passage 28 is shown in the form of a pipe, it could be defined between the wall of the vessel 2 and a partition terminating at its lower end short of the bottom of the vessel 2 and at its upper end within the outlet chamber 8 at a level below that of the aperture 16.

In the embodiments described above, all parts of the interceptor unit are accommodated in a single vessel. Alternatively, however, the various components of the unit could be manufactured as separate assemblies and interconnected on site.

CLAIMS

1. A by-pass for an interceptor, comprising an inlet chamber having an inlet and an outlet, the outlet being situated at or near the top of the inlet chamber for conveying liquid from the by-pass unit to an interceptor, the inlet chamber communicating at its lower region with an overflow arrangement which discharges at a level at or above that of the outlet of the inlet chamber, whereby, at relatively low flows through the inlet, the entire flow passes to the interceptor through the outlet, whereas, at higher flows, some of the flow passes through the overflow arrangement to by-pass the interceptor.

2. A by-pass unit as claimed in claim 1, in which means is provided for causing liquid entering the inlet chamber through the inlet to undergo a swirling motion.

3. A by-pass unit as claimed in claim 2, in which the means for causing swirl comprises a helical baffle disposed within the inlet chamber.

4. A by-pass unit as claimed in claim 2 or 3, in which the inlet is directed tangentially of the inlet chamber to provide the means for causing swirl.

5. A by-pass unit as claimed in any one of the preceding claims, in which the inlet chamber is cylindrical with an upwardly extending axis.

6. A by-pass unit as claimed in any one of claims 1 to 4, in which the inlet chamber tapers from top to bottom.

7. A by-pass unit as claimed in any one of the preceding claims, in which the inlet chamber is provided with an apertured internal partition disposed below the inlet.

8. A by-pass unit as claimed in claim 7, in which the internal partition has an apeture which is situated away from the axis of the inlet chamber.

9. A by-pass unit as claimed in any one of the preceding claims, in which the outlet comprises a conduit provided with means for restricting the flow rate of liquid through the conduit.

10. A by-pass unit as claimed in claim 9, in which the flow restricting means comprises means for causing liquid flow through the conduit to travel along a tortuous path.

11. A by-pass unit as claimed in any one of the preceding claims, in which the inlet chamber has a roof which slopes downwardly towards the sides.

12. A by-pass unit as claimed in claim 10, in which the outlet is provided at or near the uppermost part of the roof.

13. A by-pass unit as claimed in any one of the preceding claims, in which a vent pipe opens into the inlet chamber at a position above the outlet.

14. A by-pass unit as claimed in claim 13, in which the vent pipe is disposed for conveying froth or air from the inlet chamber to the interceptor.

15. A by-pass unit as claimed in claim 13 or 14, in which the vent pipe slopes downwardly away from the inlet chamber.

16. A by-pass unit as claimed in any one of the preceding claims, in which the overflow arrangement comprises a passage which is defined between a side wall of the inlet chamber and a partition, the top edge of the partition providing a weir over which flows, in use, liquid passing through the overflow passge.

17. A by-pass unit substantially as described herein with reference to Figures 1 to 3, Figures 4 and 5, Figure 6, Figure 7 or Figures 8 to 12 of the accompanying drawings.

18. An interceptor unit comprising a by-pass unit in accordance with any one of the preceding claims, and an interceptor, the outlet of the by-pass unit communicating with the interceptor.

19. An interceptor unit as claimed in claim 18, in which the overflow arrangement and an outlet of the interceptor open into an outlet chamber.

20. An interceptor unit as claimed in claim 19, in which the outlet of the interceptor comprises a transfer passage which extends from a lower region of the interceptor to the outlet chamber.

21. An interceptor unit as claimed in claim 19 or 20, in which the inlet chamber, the interceptor and the outlet chamber are accommodated in a single vessel.

22. An interceptor unit as claimed in claim 19, in which the by-pass unit is situated entirely to one side of a plane passing through an upwardly extending central axis of the vessel.

23. An interceptor unit substantially as described herein with reference to, and as shown in, Figures 1 to 3, Figures 4 and 5, Figure 6, Figure 7 or Figures 8 to 12 of the accompanying drawings.

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